Hawaii's Plant Quarantine Service—Past, Present, and Future[1]

WILLIAM C. LOOK
STATE DEPARTMENT OF AGRICULTURE
HONOLULU, HAWAII

(*Submitted for publication November, 1961*)

INTRODUCTION

Hawaii, at the crossroads of the Pacific, offers a good opportunity to study the effectiveness of plant quarantine in protecting its agriculture against the introduction, establishment, and spread of crop pests. Thousands of miles from the nearest continental land mass or other islands, this State is protected against the natural dispersal of most of the destructive plant diseases, insects, and animal pests. Even the narrow water barriers between the islands of the Hawaiian group are effective against poor- or non-flying pests. The following are a few examples of pests which are confined to infested islands by our relatively effective plant quarantines:

NAME OF PEST	FIRST REPORTED IN HAWAII	ISLANDS NOT INFESTED TO DATE
Achatina fulica Bowdich (Giant African Snail)	1938	Hawaii[2], Kauai[2], Lanai, Molokai
Anomala orientalis Waterhouse (Oriental beetle)	1912	Hawaii, Kauai, Lanai, Maui, Molokai
Coptotermes formosanus Shiraki (Formosan subterranean termite)	1913	Maui, Molokai
Fusarium cubense E. F. Smith (Panama Wilt disease)	1917	Kauai, Lanai, Maui, Molokai
Syagrius fulvitarsis Pascoe (Fern weevil)	1903	Kauai, Lanai, Molokai
Tarophagus proserpina (Kirkaldy) (Taro leafhopper)	1930	Lanai, Molokai

The strict enforcement of plant and animal quarantines by the Federal and State Departments of Agriculture undoubtedly is responsible for keeping this state relatively free from new and dangerous pests. Continued public and governmental support in continuing our quarantine program is absolutely essential to the welfare of this state.

As in every program, difficult problems exist. Flying insects hitchhiking aboard fast modern aircraft remain a constant threat. Effective methods of combating this menace are limited, but it is hoped that future research will provide some

[1] Presented at the TENTH PACIFIC SCIENCE CONGRESS of the Pacific Science Association, held at the University of Hawaii, Honolulu, Hawaii, U.S.A., 21 August to 6 September, 1961, and sponsored by the National Academy of Sciences, B. P. Bishop Museum, and the University of Hawaii.

[2] Two incipient infestations, resulting from illegal movement, reported eradicated in 1960.

solution. Maintaining an adequate staff, developing good public relations, and securing public cooperation are some of the other problems of plant quarantiue enforcement.

Objectives

To understand Hawaii's Plant Quarantine Service, a review should be made of its objectives, procedures, history, and problems. Our three objectives are:

1. To prevent the introduction of dangerous insects, plant diseases, and animal pests which may be detrimental to Hawaii's agriculture and natural resources.
2. To prevent the spread of destructive pests among the islands of the Hawaiian group.
3. To encourage our agricultural and horticultural industries by providing inspection, fumigation, and certification services on export commodities.

Procedure

To accomplish these objectives, Hawaii maintains 27 plant quarantine inspectors on four major islands today. These scientifically trained quarantine officers are on call 24 hours a day and 365 days a year. They meet and inspect every domestic ship and aircraft immediately upon arrival. The Department of Health is assisted in treating aircraft that have not been sprayed prior to landing. All plants and restricted commodities in baggage, cargo, and mail are inspected and treated when necessary. Most export nursery stock and other plant materials are inspected, fumigated and certified at the time of shipping. Certain foreign plants are inspected under post-entry quarantine by the state. All foreign arrivals on Oahu and Hawaii are met by the Federal plant quarantine inspectors who also act as collaborators of this state. The activities of the two services are closely integrated.

The Historical Past

Just as the quarantines in Europe, Australia, and California had their inception in the need to exclude crop pests, Hawaii's plant quarantine also was born of necessity. With the opening of these islands to Western civilization in the 18th century, much interest arose in developing Hawaii's land potential. Efforts were directed toward diversified crops for commercial purposes instead of cultivation for simple subsistence as practiced by the ancient Hawaiians.

Many new plants and animals were introduced by individual efforts without much order or restraint. World demand for good coffee in the early 1880's resulted in renewed interest in the importation of new varieties. However, explorers returning from the coffee-producing areas of the Orient reported a serious leaf disease of coffee there. The coffee rust, *Hemileia vastatrix* B. & Br., was devastating the coffee industries in the Philippines and Ceylon at that time.

To prevent the introduction of all dangerous coffee diseases, the Hawaiian

Kingdom enacted the first law pertaining to plant introduction. On August 11, 1888, King Kalakaua signed an act to prohibit the introduction of coffee trees and shrubs, to be enforced by the marshal or his deputy. This act was adopted only seven years after the first quarantine rules were promulgated in California, and Hawaii certainly may be considered one of the pioneers in the field of plant quarantine. Incidentally, except for minor amendments, the restriction on coffee is still in effect today.

In 1890, the Minister of the Interior was authorized by law to appoint three Commissioners of Agriculture for each port of entry to prevent the introduction of both plant and animal pests injurious to agriculture.

On May 18, 1903, the Board of Agriculture and Forestry was established under Act 44 for the encouragement and protection of Hawaii's agriculture, horticulture and forestry. Sections 13 and 14 of this act also made provisions for the inspection, treatment and quarantine of all plant materials and soil. Among other duties, the Board was authorized to make rules and regulations pertaining to subject matters of the Act. The creation of the Board was the real beginning of the Plant Quarantine Service of Hawaii. The Hawaiian Sugar Planters' Association was magnanimous in providing half the salaries of the Superintendent of Entomology and of two assistant entomologists.

Professor Albert Koebele was the first Superintendent of Entomology, who was responsible for plant quarantine. He was succeeded after three months by Mr. Alexander Craw, formerly State Horticultural Inspector at San Francisco. An inspector's assistant was employed shortly thereafter. Four Federal Collectors of Customs on the neighbor islands were commissioned Honorary Entomological Inspectors. The work of the inspectors was primarily to meet and inspect every vessel arriving in Hawaii.

Five rules and regulations were adopted by the Board and approved by the Governor during the first fiscal year. The quarantines were against the following commodities:

(1) Cacao seeds or plants from Dutch East Indies, Ceylon, and India; (2) coffee seeds or plants from Samoa; (3) pineapples from Australia; (4) banana plants and fruits from the South Pacific islands; (5) sugarcane; (6) flying fox, land crab, or other animal injurious or liable to be injurious to plant life; and (7) fresh fruits from East and West Indies, Asia, Australia, oceanic islands and Malaysia, Mexico, Central and South America.

Subsequently, several more regulations were adopted, which were essential to safeguard Hawaii, particularly against foreign materials in the absence of Federal plant quarantine legislation. Although several bills were introduced in Congress without success for more than a decade, the Plant Quarantine Act finally was approved on August 20, 1912. Hawaii's inspectors immediately were appointed Collaborators of the Federal Horticultural Board to enforce foreign quarantines. In 1928, a Federal Horticultural Board office was established locally to protect the mainland United States. Since 1949, the U.S. Department of Agriculture has

been responsible for most foreign inspections while the state inspects domestic arrivals and foreign commodities not restricted by Federal Regulations.

On October 1, 1909, Mr. Edward M. Ehrhorn, former Chief Inspector at San Francisco succeeded Mr. Craw. Separated from the Division of Entomology on July 1, 1917, the Division of Plant Inspection was recombined in September 1926 under a single Entomologist and Chief Plant Inspector, Mr. D. T. Fullaway. There were no major changes until after his retirement. On July 1, 1951, the Division was combined with the Division of Marketing. The Bureau of Plant Quarantine Inspection was one of three bureaus created by the Board of Agriculture and Forestry. The work of the three bureaus is directed by a Chief of each Branch.

The activities of the plant quarantine service gradually increased in several areas during its early years. With the discovery of the Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann), and other pests on Oahu in 1910, several interisland quarantines were adopted and had to be enforced with added personnel. The increasing postal inspection was aided greatly by the passage of the Terminal Inspection Act on March 4, 1915.

After 57 years, the Board was reorganized into the Department of Agriculture and Conservation on January 23, 1960 after statehood was attained. On July 1, 1961 it was renamed the Department of Agriculture, which now contains the Plant Quarantine Branch in the Division of Plant Industry.

The Changing Present

Modern aviation developed several new trends in our plant quarantine work. The danger of transporting live insects thousands of miles across ocean barriers now threatens many nations. Today, we are only four to four and one-half hours from the mainland. Air specialists already are talking of reducing that time to one or two hours in the near future.

Although the first commercial trans-Pacific flight was in 1935, the greatest developments came after World War II. Several commercial airlines were authorized to fly between Hawaii and the mainland. There was much movement of passengers and plant materials to and from Hawaii as well as between the islands. Our inspectors had to be diverted toward this new phase of work. Today an average of 16 air flights arrive daily from the continental U.S.

Aviation opened new markets for our tropical nursery stock, orchid plants, cutflowers, and foliage. All of these export materials require time-consuming inspection and certification. The number of plant materials inspected jumped from 15,126 parcels in 1944 to more than a million during the peak period ten years later.

The importation of valuable plants, such as orchids, from many distant countries added to our workload. Such foreign plants often must be placed under post-entry quarantine surveillance for a minimum of two months or two growing

seasons. During the peak period of introduction from 1953 to 1958, 466 lots consisting of 31,165 orchid plants were placed under post-entry quarantine and re-inspected at regular intervals.

Early in 1960, specially constructed containers were first used to transport maritime cargo. Now, refrigerated containers bring fresh produce directly to the doors of the importers, and the staff has to work the piers, marshalling yards, and private premises. Infested cargoes in containers were often found and fumigated on the spot under nylon-plastic covers. These treatments were done by commercial fumigation companies under our supervision.

Special quarantines against the burrowing nematode, *Radopholus similis* (Cobb) Thorne and fruitflies such as *Dacus dorsalis* Hendel add to the complexity of certification. Time-consuming inspection techniques for nematodes and fumigation treatments have to be performed or supervised. For example, all rooted plants for export to Arizona, California and Louisiana must be certified as follows:

(1) It has been determined by competent official surveys that the burrowing nematode does not exist on the property or premise on which the materials were grown; or (2) the restricted materials have been produced from seed or from propagating plant parts determined to be free from burrowing nematode and have been grown or safeguarded above ground in materials free from burrowing nematode until shipped.

Inspection of air and sea movements between the islands has been intensified to intercept giant African snails and other pests.

Quarantine Restrictions in Effect

In addition to the plant quarantine statutes, current regulations include nine import quarantines, ten inter-island restrictions, and one export regulation. Seventeen specific insects, fungi and viruses are restricted by the import quarantines. Seven major but not widely distributed pests are prohibited movement between the islands. The export regulation provides for the inspection of rooted plants to meet special quarantines against the burrowing nematode. The restrictions in effect and pests quarantined are as follows:

Regulation and Commodity		Restrictions
Basic Laws		
Section 26-1	Revised Laws of Hawaii 1955	Conditions of importation for plant materials and non-domestic animals.
Section 26-2	Revised Laws of Hawaii 1955	Prohibition against snake, flying fox, fruit bat, Gila monster, injurious pests and sand, soil or earth.
Section 26-3	Revised Laws of Hawaii 1955	
Section 26-4	Revised Laws of Hawaii 1955	Transporting in State.
Import Regulations		Pests Prohibited
Reg. 1.1	Sugarcane (*Saccharum*) and other gramineous plants	*Diatraea saccharalis* (Fabricius) *Castnia licoides* Boisd. *Ustilago scitaminea* Syd.
Reg. 1.2	Pineapple [*Ananas comosus* (L.) Merr.] and other bromeliaceous plants	*Anomocaulus fulvovestitus* Fuern. *Frankliniella schultzei* (Trybom.) *Metamasius* spp. *Thecla basiliodes* Geyer

Reg. 1.3	Coffee (*Coffea*) plants and parts thereof	*Stephanoderes hampei* Ferr. *Hemileia vastatrix* B. & Br.
Reg. 1.4	Cruciferous vegetables	*Hylemya brassicae* (Bouché)
Reg. 1.5	Orchid plants (Orchidaceae)	*Diorymerellus laevimargo* Champion *Parallelodiplosis cattleyae* (Molliard) *Tenthecoris bicolor* Scott
Reg. 1.6	Banana (*Musa*) plants	*Cosmopolites sordidus* (Germar) *Metamasius hemipterus* L.
Reg. 1.7	Passion fruit (*Passiflora*) plants and seeds	*Scolypopa australis* Walker "Woodiness disease"
Reg. 1.8*	Pine (*Pinus*) plants *Rhyacionia buoliana* (Schiff.)	
Reg. 2	Non-domestic animals including birds, insects and reptiles	Animals detrimental to agriculture
Reg. 3	Bacterial, fungus or virus cultures	Organisms detrimental to agriculture
INTER-ISLAND		
Reg. 4	Movement of plant materials between the islands	Various pests
Reg. 4.1	Sugarcane plants and parts thereof	*Anomala orientalis* Waterhouse
Reg. 4.2	Restrictions on soil	*Anomala orientalis* Waterhouse *Coptotermes formosanus* Shiraki
Reg. 4.3	Fern plants	*Syagrius fulvitarsis* Pascoe
Reg. 4.4	Movement of giant African snails	*Achatina fulica* Bowdich
Reg. 4.5	Movement of taro plants and parts thereof	*Tarophagus proserpina* (Kirkaldy)
Reg. 4.6	Banana plants	*Fusarium cubense* E. F. Smith
Reg. 4.7	Cactaceous plants	*Dactylopius* sp.
Reg. 4.8	Noxious weeds	Various species
Reg. 5	Authority to enter public and private premises for inspection, etc.	
Reg. 6	Authority to inspect and certify rooted plants for export.	*Radopholus similis* (Cobb) Thorne

* Adopted December 1961.

THE CHALLENGING FUTURE

Increased demands for various plant quarantine services can be expected in the future. The growing acceptance of point-of-origin certification by the states and foreign countries necessitates changes in our present system of inspection. The time-consuming inspection of large commercial shipments of nursery stock at the time of shipping should be replaced by inspection at the premises. The establishment of nursery inspection services on all of the major islands is one of the challenging goals of the Department. Premises will be inspected regularly for insects, pests, and burrowing nematodes before approval. Lack of personnel is one of the obstacles and acceptance by the industry and the many back-yard growers is another.

As the containerization program proves advantageous, more door to door deliveries will be made. Demands for inspection will increase and be difficult to meet even on reimbursable overtime basis. Should the ceiling against additional personnel be continued, it will create hardships on the shipping industry as well as on the department. We may have to insist on the establishment of centralized warehouses or markets to facilitate container inspection.

The development of new treatments against fruit insects and nematodes would result in added activities. An ethylene-dibromide dip for papayas has been developed and is awaiting approval from Washington. Gamma irradiation as a possible commodity treatment against fruitflies is being studied locally by the U.S. Department of Agriculture. Undoubtedly, other new materials and methods may be developed. Should any of these treatments be effective, practical and acceptable, more fresh fruits and vegetables will be exported. Until the industries are able to install the costly equipment, the state may be expected to provide the facilities and supervision of the treatments. This was done immediately upon approval of the EDB treatment for papayas and other fruits.

Our program will become more and more difficult to carry out. We anticipate one- to two-hour flights from the mainland, more direct flights to the neighbor islands, new seaports of entry, intensified surveillance of inter-island movement of plant materials, and increased interest in tropical plants and fruits throughout the world. To perform these functions, we must solicit the support of the public and the legislature in continuing our plant quarantine program.

SALE OF BACK NUMBERS

A limited supply of most of the back numbers of the PROCEEDINGS OF THE HAWAIIAN ENTOMOLOGICAL SOCIETY is available and may be purchased from the Society at the following prices:

vol. 1, nos. 1–5 (1906–1908)	$1.00	per number
vol. 2, no. 1 (1908)	1.00	" "
vol. 2, nos. 2–5 (1909–1913)	5.00	" "
vol. 4, nos. 2–3 (1920–1921)	5.00	" "
vol. 5, nos. 1–3 (1922–1924)	5.00	" "
vol. 6, nos. 1–2 (1925–1926)	5.00	" "
vol. 7 thru 17 (current); each volume containing three numbers (1928–1961)	5.00	" "

The following numbers are out of print: Vol. 3, nos. 1–5 (1914–1918); vol. 4, no. 1 (1919); vol. 6, no. 3 (1927).

Indices are available with purchase of entire volumes.

Orders from outside the United States must be prepaid and shipments to foreign countries are made at purchaser's risk.

Orders should be addressed to the Secretary, Hawaiian Entomological Society, 1527 Keeaumoku St., Honolulu 14, Hawaii, U.S.A.